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THE SIXTEENTH INTERNATIONAL GEOLOGICAL CONGRESS

By Dr. W. C. MENDENHALL

DIRECTOR OF THE U. S. GEOLOGICAL SURVEY AND GENERAL SECRETARY OF THE CONGRESS

THE Sixteenth International Geological Congress met in Washington, D. C., the week of July 22 to 29. A total of 1,181 geologists and organizations enrolled as members of the congress, and of these about 165 foreign and 500 American geologists attended the session in Washington. Thirty-four foreign countries were represented by official delegates.

The Geological Congress meets every three or four years. Each congress includes council meetings and general meetings for the transaction of business, reports of international commissions and sectional meetings at which scientific papers are presented. In connection with the congress a series of excursions designed to show visitors the major features of the geology of the host country is arranged.

The Sixteenth Congress was opened on July 22 with an address by A. L. Hall, general secretary of the Fifteenth Congress, held in South Africa in 1929. The Honorable Harold L. Ickes, Secretary of the Interior of the United States, welcomed the members on behalf of the government. Waldemar Lindgren, president of the Sixteenth Congress, C. K. Leith, president of the Geological Society of America, which generously financed the congress, and W. C. Mendenhall, general secretary of the Sixteenth Congress, made brief addresses.

A number of topics were selected by the organization committee as especially important at this time, and papers and discussions on these topics were invited.

(1) *Fossil man and contemporary faunas.* Sir Arthur Smith Woodward,[1] in the opening paper of the section, reviewed the distribution of early man in the Old World and presented the thesis that human remains found in Tanganyika Territory, indistinguish-

[1] SCIENCE, vol. 78, pp. 89–92, Aug. 4, 1933.

able from *Homo sapiens* but associated with an early Pleistocene fauna, indicate the general center in which the human race developed. The contemporary primitive types, such as *Eoanthropus* in England, *Pithecanthropus* in Java, and *Sinanthropus* in China, all of early Pleistocene age, represent the marginal remnants of an earlier wave or waves of migration from the African center, still enduring with but little change, whereas in the African center the advance had gone on to the stage of *Homo sapiens*. The variability of *Homo neanderthalensis* of the middle Pleistocene in Europe, it was suggested, means that the species was dying out, not that it was giving rise to *Homo sapiens*. *Homo neanderthalensis* and *Homo sapiens* are both to be viewed as representing waves of migration, the former perhaps replacing the primitive types and then itself being replaced.

Davidson Black presented a summary of the latest work on *Sinanthropus,* the recently discovered fossil man of China, and the rich fauna associated with his remains. A special publication presenting more fully the results of this work had been prepared for distribution at the congress. S. K. Sanford spoke of the migrations of earlier man in the southern Libyan Desert, where at times a relatively large population managed to subsist. Progressive desiccation eventually drove these people to the scarps bordering the desert and to the Nile Valley, though there were variations of climate that permitted some abandoned areas to be reoccupied for a while.

A group of papers presenting the latest knowledge on fossil man in America was brought together for the congress by John C. Merriam. Chester Stock described recent finds from caves in various parts of the Southwest, and Barnum Brown those from Folsom, New Mexico. Dr. Merriam summarized the evidence from finds in different parts of the country. In all, the human remains or artifacts are associated with many extinct vertebrates, but the authors seem to be agreed that it is more probable that certain animals which have been generally believed to have become extinct at the end of the Pleistocene survived into post-Pleistocene time than that the remains of man hitherto found in this country are of Pleistocene age.

E. C. Eckel and Junea W. Kelly offered the thesis that the occurrence in Pleistocene deposits of the Appalachian region as far south as Georgia of remains of the tamarack larch, now found only in the north, shows a great migration of living things far southward in Pleistocene time. As there is an abandoned shore line at the present 250-foot level, the authors believe that the Appalachian region was isolated by ice on the north and by the sea on the other sides, thus restricting a possible habitat for early man to that region.

(2) *Batholiths and related intrusives.* In the section on "Batholiths and related intrusives" many stimulating papers were read. F. F. Grout presented evidence, chiefly on the relations between the orientation of minerals in the Saganaga granite mass of Minnesota-Ontario and the attitude of the unconformably overlying Ogishke conglomerate, strongly suggesting that the granite mass has been tilted about 70° since its consolidation. Some horizons now exposed were once, he thought, 20 miles below the surface. The suggestion was made that these deepest parts were rootlike feeders of the main mass. These feeders strikingly resemble petrographically the main mass and top of the granite.

Papers on the origin of granite magmas were offered by W. H. Collins, Pentti Eskola and J. J. Sederholm.

Hans Cloos, in a general paper, pointed out the similarity in the movements of liquid plutonic masses and of their walls, and the continued tectonic influence of the masses after they become solid and "dead."

The anorthosites of Norway were discussed by C. F. Kolderup, who argued for their normal intrusive origin, and by T. F. W. Barth, who interpreted them as the crystal residue from the filter-pressing of a more complex magma.

N. L. Bowen and J. F. Schairer, having worked out the melting relations in the olivine group, found that the melting-point of intermediate members was not, as supposed by J. H. L. Vogt, much below that of the pure magnesia olivine forsterite. In view of the absence of evidence of high-temperature effects around bodies of the olivine rock dunite, they questioned whether these bodies were ever wholly liquid and suggested their emplacement as loose masses of crystals.

The small lenticular intrusive bodies called phacoliths received attention in two of the most suggestive papers. A. F. Buddington described gravity-stratified sills in the northwestern Adirondacks, emphasizing the fact that the linear parallelism in these masses was a later metamorphic feature, independent of their emplacement. Similar conclusions were reached by H. B. Stenzel from a study of a granite mass near Llano, Texas. Attention was directed by F. E. Suess to the necessity of demonstrating the magmatic origin of linear parallelism in igneous masses before drawing conclusions as to their mode of emplacement, and James Gilluly pointed out the valuable tool in discriminating magmatic and postmagmatic structures now available in statistical studies of mineral orientation by Sander's method.

(3) *Orogenesis.* The problems of structural geology considered by the congress ranged widely over the field, including questions of ultimate causes of crustal disturbance, regional correlations and classifications of rock structures.

The energy sources of crustal disturbance were attributed by Arnold Heim to cosmic impulses, which altered both the position of the earth's axis and the rate of rotation of the earth in geologic time. The stresses thus set up he regards as adequate for all mountain building and as important factors in magmatic development.

Correlations of the structural history of Europe and North America were presented by Hans Stille, who considered them closely related. F. E. Suess, on the other hand, emphasized the differences in the structural development of the two continents. Axel Born concluded, from regional correlations, that broad continental uplifts and subsidences (epeirogeny) and mountain building (orogeny) both occur in rhythmic cycles, but he believes that the rhythms are independent. W. J. Arkell, in an analysis of the Mesozoic and Cenozoic folding in England, showed that the Triassic depression was independent of the grain of the Paleozoic foundation. Minor onsets of compression resulted in rejuvenation of the axes of the Paleozoic basement, but the powerful Alpine orogeny was controlled by the Jurassic troughs of sediments. Hellmut de Terra offered a correlation of the structural evolution of the Alps with that of the Himalayas. A. Demay pointed out the analogous structures at different places along the Hercynian mountain systems of Europe.

Bruno Sander presented his method of study of "petrofabrics" (Gefügekunde der Gesteine). By studying and charting the orientation of mineral grains and structures of deformed rocks he is able to analyze the movements in the rocks and to determine the superposition of one deformation upon another. His analysis shows that there are two varieties of mineral parallelism (linear schistosity) in rocks, one parallel, the other normal to the movements in the rocks.

Mountain (and island) arcs are regarded by T. Tokuda as caused by continental drifting.

Papers by Ramiro Fabiani on Sicily and by D. C. Barton on the structural basin of southern Bavaria represent attempts, in a direction that holds much promise for the future, to interpret large geologic structures on the basis of geophysical observations.

Interesting local orogenic studies were presented by H. D. Miser (Ouachita geosyncline), Robert Balk, (southern New York), Thorolf Vogt (Scandinavia and Spitzbergen), H. A. Brouwer (Celebes), R. H. Dott (Arbuckle Mountains), and several others.

(4) *Measurement of geologic time.* Many methods for measuring geologic time have been suggested in the last few years. In a discussion of these methods two seemed to be in most general use at present for measuring the number of years since geologic events —the ratio of radium G(Pb 206) to uranium, and the number of "varves" (annual layers of sediment deposited in quiet bodies of water) providing a very accurate chronology similar to tree rings. The variations in the thickness of varves, corresponding to variations in the character of the seasons, has permitted Gerard De Geer to correlate sequences from different localities without direct tracing. By the use of synchronous varves and tree rings Mrs. Ebba De Geer believes she has made it possible to carry our calendar back into glacial times. Ernst Antevs announced that by study of varves he had been able to determine periods of highest summer temperature in the late Quaternary, thus providing a possible means of long-distance correlation of these deposits. The use of summer temperature for correlation, he said, has received a decided impetus through its probable astronomical explanation by Rudolf Spitaler, who believes that warm summers in the northern hemisphere occur when the earth is nearest the sun during the northern summer and the eccentricity of the earth's orbit is fairly large.

(5) *Geomorphogenic processes in arid regions.* The land forms of desert regions are so different from those of humid regions and there is so much difference of opinion as to their origin that processes of land sculpture in arid regions was selected as one of the main topics for discussion.

K. S. Sandford analyzed the stages in development of the Libyan Desert. Arid conditions apparently began in certain areas, each unit area being controlled in its development by local base-levels. These desert peneplains gradually expanded and eventually merged into a vast desert.

Fritz Jaeger attributed the depressions known as lime pans, in arid Southwest Africa, to deposition of lime on vegetation growing near the shores of small ponds—mostly remnants of old stream channels—toward the end of a wet period preceding the present arid period.

Papers and discussion by N. G. Hörner, Eliot Blackwelder and G. W. Grabham emphasized the fact that heating by day and cooling by night is a negligible factor in the disintegration of rocks in deserts, and that it is only where the rocks are occasionally wet and where salts crystallize between their grains that they disintegrate notably. Hörner believes that denudation in the desert is very slow. His study of wind action convinced him that on rock and gravel surfaces it is almost negligible, but on waterlaid silt and fine sand it is of regional importance as an erosive agent. The finest particles come to rest as loess where, outside the arid region, moisture causes slight cementation. The coarser material forms extensive dune areas. The main loess formation probably coincides with the drying of great ancient lakes.

According to G. B. Barbour's analysis, there were two epochs in which a large amount of loess was deposited in North China—the Sanmen (Plio-Pleistocene) and the Malan (upper Pleistocene). In the Malan epoch loess deposition was uninterrupted. The Sanmen epoch was longer and was interrupted at times when mature soil profiles were developed, giving superimposed "fossil" soil surfaces which can be dated by fossil evidence. V. K. Ting, however, contended that there is but one loess formation in that region.

The greater part of the basin deposits in the arid Southwest, according to Kirk Bryan, are not receiving additions now but are deformed middle and late Tertiary beds laid down in basins which in general coincide with existing down-faulted blocks. The present fault-block mountains are hence the product of several periods of faulting. Ephemeral streams in early Pleistocene time graded pediments across softer late Tertiary beds of the depressed blocks to local base-levels.

(6) *Major divisions of the Paleozoic era.* One of the most interesting features of the section was the discussion of methods used for determining the relative ages of rocks of different continents. Papers by E. O. Ulrich and others emphasized the use of unconformities, the physical evidence of longer interruptions of deposition between rocks, and other types of physical evidence, for correlating distant beds and drawing boundaries between the rocks of different geologic periods; whereas most of the papers given by European authors and discussions by some American geologists argued that fossils are the most practical means of correlating widely separated rocks. Advocates of the use of fossils considered that, even though in some localities index fossils had to be arbitrarily selected, they are more practical for this purpose, because, as shown by several papers, large areas are known where there was no interruption of sedimentation from one period to another and also because in other areas it is impossible to distinguish which of several unconformities is the most significant.

An interesting proposal was that of A. W. Grabau and V. K. Ting, to increase the thickness of the Permian system greatly by adding to it rocks generally included in the Carboniferous of Europe and Asia under the epoch name Uralian. This proposal would also greatly increase the length of Permian time. It was especially interesting as contrasted with a paper by R. C. Moore, which would absorb the whole Permian period into the Pennsylvania period. According to another proposal made by Moore the Pennsylvania and Mississippian periods would replace the widely used and long established Carboniferous period. These proposals constitute a renewal of previous attacks on the Permian period and a renewed attempt by an American geologist to induce geologists of other continents to use the American terms Mississippian and Pennsylvanian. They provoked considerable discussion. Several objections were made to them, and considerable disagreement arose over the location of the boundary between the Mississippian and Pennsylvanian rocks in the south-central part of the United States. The use of the term Carboniferous in most papers given at the congress by European geologists suggests that, although a considerable number of American geologists have discarded it in favor of the two American terms, these terms have not made much headway in Europe.

A significant contribution to the Permian problem was made by David White, who discussed the evidence of fossil plants in fixing the Permian boundaries in North America and indicating the climatic changes of the early Permian in this country. A. L. du Toit gave evidence to show that the ancient (late Paleozoic) glacial deposits, now known to be wide-spread over the entire southern hemisphere, were not, as has been suggested, confined to a short time range in the Permian but were formed at several different times during both the Carboniferous and Permian periods.

Another interesting feature was the discussion of the validity of the Ozarkian, proposed some years ago by E. O. Ulrich as a new geologic period and named from rocks exposed in the Ozark region of the central United States. A special evening meeting was devoted to continuing the discussion of this question. Papers presented on the lower Paleozoic rocks of Great Britain and on the Cambrian and Ordovician systems of Asia implied that the Ozarkian was not recognized as a valid period in those areas.

(7) *Geology of petroleum.* In a symposium on the geology of petroleum great interest was shown in the origin and accumulation of oil. Two points of view appeared—one that oil migrates long distances (because of hydrostatic pressure) until it is finally trapped on the flanks of folds or by other structural barriers; the other that oil is formed in approximately the place where it is found.

F. R. Clark suggested that the rich accumulations of organic matter which are the source material of oil were deposited in restricted areas near or in contact with the reservoirs that trap the oil because conditions in most oil pools indicate that free oil has not migrated over long distances.

A. I. Levorsen[2] showed that study of the ancient geology of petroliferous regions may aid in explain-

[2] A. I. Levorsen, "Studies in Paleogeology." Am. Assoc. Petroleum Geologists *Bull.*, vol. 17, no. 9, September, 1933.

ing unusual occurrences of petroleum. By geologic maps showing the areal geology and regional structure of the United States in late Paleozoic and early Cretaceous time, he was able to determine the history of the migrations of petroleum in a stratum and to select those geologic structures which are likely to contain oil. His maps indicate that many areas which now contain well-developed anticlines were not favorably situated in the earlier geologic history of the reservoir stratum and, as is frequently proved by drilling, have therefore not trapped petroleum. Other areas furnishing only a small trap for oil have been more advantageously situated in the past and are found to be richly petroliferous.

Hydrogenation—an increase in the hydrogen-carbon ratio—appears, according to W. E. Pratt, to take place during the evolution of petroleum deposits in a manner analogous to the commercial process of hydrogenation. The source of the hydrogen may be the methane that usually occurs with petroleum in nature, and the saturation may be accomplished by the incorporation of methane into the unsaturated molecules by methylation.

Studies by Taisia Stadnichenko show that oil and gas are formed from the different organic constituents of such rocks as oil shales, carbonaceous shales, bogheads and cannels, at different temperature points or zones, indicating that the petroleum found in our oil fields may contain products generated at several stages in the long course of the devolatilization of the organic matter in the sediments.

Zonal relations of metalliferous deposits. Most of the papers in this section, especially those by Svitalsky, Ahnert, and Behre and his co-authors, dealt with variations in areas of mineralization rather than with variations in individual veins—the latter, as noted by Behrend, being uncommon in many regions, although, as shown for southern Virginia by Brown, they may exist in such form as to be evident only as a result of quantitative studies. Among the obscuring factors mentioned are separation in time and space of different pulsations of mineralization in a genetically homogeneous metalliferous province, such as the Freiberg district (Schumacher); mutual interference of zones surrounding closely spaced centers of mineralization, as in Colorado (Behre and associates); the effects of different wall rocks (Bruet and others); and the possible effect of regional tilting in changing the vertical relations of lodes deposited prior to the tilting, as in the Triassic areas of the eastern United States (Newhouse).

INTERNATIONAL COMMISSIONS

Of the international commissions appointed by the congress, those to which is assigned the task of producing a definite publication—a map or a book—always face the problem of procuring funds, as the congress itself has no continuing funds. The most successful commissions of this kind have been the two which are charged with producing a geologic map of the earth and one of Europe. The direction of these two enterprises has been in the hands of the Geological Survey of Prussia, which has itself contributed much of the work and succeeded in raising additional funds by subscription and sales. The commission for the geologic map of the world is next to take up North America, where it will doubtless be greatly aided by the new geologic map of the United States prepared for the congress by the United States Geological Survey.

Less successful hitherto has been the commission charged with the republication, on standard-sized cards, of illustrations and descriptions of type fossils, but there are prospects that an enterprising group of French geologists may find a publisher willing to issue the cards on a commercial basis.

The commission engaged in preparing a lexicon in which the names given to strata or groups of strata in different parts of the world are defined, although it has a large amount of material ready, has not yet succeeded in obtaining funds for publication.

Other commissions, such as that dealing with fossil man and that dealing with the deposits of the Gondwana system, the peculiar deposits of the southern hemisphere which include the ancient glacial deposits of Permian time, submitted valuable scientific reports for publication in the general report of the congress.

The commission which at each congress awards to some particularly promising young geologist of the country in which the congress is held a prize given to the congress by a Russian, Spendiaroff, in memory of his son, this year selected Thomas B. Nolan, of the United States Geological Survey.

As science becomes more specialized and the number of special associations increases, overlaps of activities are inevitable. To avoid wasteful duplication that might result from such an overlap, the congress voted to transfer to a commission on glaciers of the International Geophysical Union the functions and records of a commission of its own which had been dealing with studies of the movement of glaciers.

Problems created by this multiplication of special associations came before the congress in another form when Arnold Heim, of Switzerland, proposed that the Geological Congress meet every five years instead of every three years, as has been traditional. He pointed out that there are now twelve such international gatherings in zoology, botany, geography, physics, etc. If each of these met every three years there would be four such meetings a year, and the

cost of sending delegates to each of them would be too great for a small country like Switzerland. Decision on the question had to be deferred to the next congress.

This congress, however, tended to add to the number of these international associations by the efforts made by some of its members, led by B. F. Howell, of Princeton, to form an International Paleontological Union; by approving the expansion of the Association for the Study of the Quaternary Period of Europe into a world-wide association; and by the formation, by some of its members, under the leadership of J. J. Sederholm, of Finland, of an association for the study of the Precambrian rocks, the oldest known rocks of the earth, whose complicated relations are only slowly being unraveled.

Workers in other branches of science may be interested in the resolution submitted by O. T. Jones, of Cambridge, England, and passed by the congress, petitioning the governments represented at the congress to permit the importation, duty-free, of geophysical instruments borrowed for a limited period.

The congress voted unanimously to accept the invitation for the next session presented by the Union of Soviet Socialistic Republics.

At the closing meeting delegates from the guest nations made addresses of thanks and appreciation, and a letter of greeting and good wishes from President Roosevelt was read.

Entertainment

The evenings during the sessions were given over to less technical talks and to social events. On the first night of the session the Geological Society of Washington entertained the members of the congress at a smoker at which Douglas Johnson gave an account of some of the representative geomorphic features of the United States.

On Sunday afternoon Dr. Whitman Cross, who had been assistant secretary of the International Geological Congress held in Washington in 1891, and Mrs. Cross entertained the Congress in their lovely garden in the suburbs. The foreign guests were much interested in the singing of American Indian songs and Negro spirituals by members of those races. That evening Hellmut de Terra gave an account, illustrated with motion pictures, of his explorations in the Himalayas.

On Monday evening the Bureau of Mines presented its motion picture dramatizing the evolution of the oil industry. On Tuesday evening Frank Adams,[3] in commemoration of the completion of Lyell's "Principles of Geology" in 1833, reviewed the life and work of that founder of modern geology. On behalf of the scientists of the nation, the National Academy held a reception for the members of the congress on Thursday evening.

Excursions

One of the most important features of each International Geological Congress is the program of excursions offered to members. These give visiting geologists an opportunity to study the geology of the host country and give universities and museums the opportunity to round out their collections by having their representatives collect specimens.

In preparation for the excursions in the United States in connection with the Sixteenth Congress, held at Washington in July, a set of 31 guide-books was prepared, covering to a large extent the regional geology of the entire country. Those geologists, in all about 170, most familiar with the different areas undertook the authorship of parts of the guide-books. All the guide-books were published by the Geological Survey except two, the manuscripts of which were received after the appropriation had lapsed. In addition special guide-books were prepared for the scientific institutions of New York and Washington.

Although each excursion was generally in charge of a single leader, a large number of geologists assisted, so that, in general, for each day's work the members had the benefit of guidance by the American geologist most familiar with the particular area visited on that day.

In addition to the more formal excursions of the type ordinarily given for the International Geological Congress, the fact that most of the foreign visitors landed in New York made it appropriate to offer a special series of short excursions in the vicinity of that city. These were arranged by a committee of New York geologists under the chairmanship of C. P. Berkey and included both trips of general interest —such as orientation trips, visits to the principal scientific institutions of New York and an exposition of the geologic features of New York—and trips designed for specialists, such as those emphasizing glaciology, stratigraphy, mineralogy and engineering geology.

Similarly during the session at Washington it was possible to arrange short field trips to near-by points of interest, including Appalachian stratigraphy and structure in Virginia and Pennsylvania, the Precambrian of Maryland and Pennsylvania, the Coastal Plain of Maryland, the titanium and soapstone deposits of Virginia and the Cornwall iron mines of Pennsylvania. Short afternoon trips were made to the scientific institutions of Washington.

The longer excursions before the session were chiefly in the eastern and southern states, and those after the session in the western and central states.

[3] SCIENCE, 78: 178–183, September 1, 1933.

Except for the two transcontinental trips, which were necessarily more general in nature, these were arranged to be of interest to specialists in various branches of the science. The unfavorable economic conditions reduced participation below earlier estimates, but, on the other hand, the generosity of the Geological Society of America, by making it possible to offer the excursions at a considerable reduction below actual cost, allowed a larger attendance than would otherwise have been possible.

Of the shorter excursions, eight before and two after the session, three primarily featured stratigraphy, four economic geology, one petrology and structural geology, one geomorphology and one glacial geology.

One of the stratigraphic excursions, A–4, under the leadership of D. H. Newland, covered the classic early Paleozoic section of New York between Albany and Buffalo. A–3, led by Charles Butts, G. W. Stose and Josiah Bridge, covered the Paleozoic stratigraphy of the southern Appalachians between Washington and Bristol, Tennessee, studying not only the stratigraphy of the region but the recent structural interpretations of this complex area. The stratigraphy of the Coastal Plain was studied in excursion A–5, which traveled by yacht under the direction of L. W. Stephenson through the Potomac estuary and up Chesapeake Bay, visiting the well-known fossil localities of the region.

Of the four excursions grouped as primarily of economic interest, one, C–4, led by W. O. Hotchkiss and C. K. Leith, was in large part devoted to a study of the Precambrian stratigraphy of the Lake Superior region between Marquette and the Mesabi range. The excursion not only gave opportunity for the study of the iron and copper deposits, but the Lake Superior geologists who acted as leaders and guides were able to explain in this field the intricacies of the interrange correlation of the Precambrian formations and the complexities of the regional geology.

The many and varied mineral deposits, both metallic and non-metallic, of the eastern and central states were covered by two excursions—A–8, led by C. P. Berkey, and A–2, led by J. T. Singewald, Jr. Excursion A–8 covered the territory between New York and Washington, visiting Franklin Furnace, New Jersey, the slate, cement and anthracite districts of eastern Pennsylvania and the Cornwall iron deposits of Pennsylvania. Excursion A–2 was the principal mining excursion of the congress and covered a much wider territory. A coal mine and steel plant of the Pittsburgh district were first visited, then the fluorspar mines of southern Illinois, the iron and lead deposits of southeastern Missouri, the Tri-State zinc-lead region, the Arkansas bauxite deposits, the petrologically interesting Magnet Cove locality in Arkansas, the iron and coal mines of Birmingham, the Ducktown copper deposits and the zinc deposits of Mascot and Jefferson, Tennessee. The third economic excursion, A–6, under the direction of W. E. Wrather, emphasized oil geology, including oil fields in Oklahoma and Texas, a trip across Paleozoic formations of the Arbuckle Mountains, the Fort Worth Cretaceous section, the east Texas oil field, and the oil and sulfur-producing salt domes of Texas, returning to Washington by way of New Orleans.

Excursion A–1, under the direction of C. R. Longwell, covered the varied geology of eastern New York and western New England, including the Adirondack anorthosite area, the structurally complex regions of Vermont and western Massachusetts and the Triassic basin of southern New England.

While geomorphology was to some extent a feature of all the excursions, it was particularly the object of excursion A–8, which was conducted by Douglas Johnson from New York to Harrisburg and thence to Washington.

The glacial geology of the central states, including parts of Illinois, Iowa and Wisconsin, was covered by excursion C–3, under the direction of M. M. Leighton.

The two transcontinental excursions, C–1 and C–2, each had equipment consisting of two Pullmans (the well-known "Princeton" with C–2) and, through the courtesy of the Baltimore and Ohio Railroad Company, a baggage car fitted with shower baths, racks for specimens and work tables. Although it was not possible in such long and varied excursions to cater entirely to specialists, C–2 stressed particularly stratigraphy and structural geology, and C–1 offered opportunities for a rapid study of the major mining districts of the West, with optional excursions for those to whom economic geology had less appeal.

Excursion C–2, led by R. M. Field on the way west visited the Grand Canyon by way of Meteor Crater and Canyon Diablo and spent a day in the Los Angeles region and a day on the San Francisco Peninsula. A motor trip was made to Crater Lake from Klamath Falls and a two-day trip from Eugene, Oregon, across the John Day Basin to Wishram, Washington. After stops at the Grand Coulee, near Spokane, and at Butte, came the principal feature of the excursion, a six-day motor trip through the Yellowstone National Park and the Big Horn, Beartooth and Pryor Mountains, with study of the structural and stratigraphic features. The party then spent two days in the Black Hills.

Excursion C–1, under the leadership of Waldemar Lindgren, went west by a more southerly route, making El Paso its first stop. Here the party divided, one group visiting the Marathon Basin and Carlsbad Caverns, while the other studied the ore deposits of the Santa Rita and Bisbee districts. In the Los Angeles area the program included a short trip along

the San Andreas fault and two days of study of the stratigraphy, structure and oil fields of the region. After a day spent on the San Francisco Peninsula and Berkeley Hills, the party moved to the Yosemite National Park and again divided, one group going by bus across the Tioga Pass to Mono Lake, Lake Truckee and Reno, and the other visiting the mines of the Mother Lode. At Salt Lake likewise two sets of excursions were available. Some preferred to visit Zion and Bryce Canyons and the north rim of the Grand Canyon. For those who remained in Salt Lake there were visits to the principal mines of the Bingham, Park City and Tintic districts and trips to localities of structural and general geologic interest. In Colorado there was a choice of three options; the most popular excursion visited the mining districts of Gilman, Leadville, Alma and Cripple Creek; another trip crossed the San Juan Mountains, and the third allowed study of the stratigraphy and structure of the Front Range between Minturn and Colorado Springs.

The success of all the excursions was, of course, due in great measure to the volunteer assistance rendered, often at considerable personal inconvenience, by all geologists and mining engineers whose fields of work lay within the regions visited. To a great extent, moreover, the officers of the congress are indebted to the hearty cooperation and cordial hospitality offered by all residents of the regions traversed. In particular, most cordial cooperation was afforded by the officers of the National Park and Forest Services and all civic organizations.

A HISTORY OF THE NATIONAL RESEARCH COUNCIL, 1919-1933

X. THE DIVISIONS OF GENERAL RELATIONS[1]

By ALBERT L. BARROWS
ASSISTANT SECRETARY

IN addition to its divisions of science and technology established for the direct encouragement of scientific research, the National Research Council has maintained four divisions of general relationships. These divisions are concerned with the relations of the Council to the Federal Government, to international scientific organizations, to conditions of research in scientific agencies of state governments and to research interests in educational institutions.

Division of Federal Relations: During the World War special contacts were maintained between the National Research Council and the War and Navy Departments of the Government through a Military Committee of the Research Council, composed of representatives of these two departments and of various scientific bureaus of the Government. The Executive Order of President Wilson of May 11, 1918, requested the National Academy of Sciences to perpetuate the National Research Council for the stimulation of research "with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare," and specifies that the duties of the Council shall be, among other functions:

> To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the War and Navy Departments and with those of the civil branches of the Government.
>
> To direct the attention of scientific and technical investigators to the present importance of military and industrial problems in connection with the War, and to aid in the solution of these problems by organizing specific researches.

This Executive Order further directs that "the cordial collaboration of the scientific and technical branches of the Government, both military and civil" be given to the Council, and that "to this end representatives of the Government, upon the nomination of the President of the National Academy of Sciences, will be designated by the President as members of the Council, as heretofore, and the heads of the departments immediately concerned will continue to cooperate in every way that may be required."

In order to carry out these instructions the National Research Council includes a Division of Federal Relations, composed of representatives designated in accordance with the Executive Order. This division now contains 43 members, representing the ten departments of the Federal Government or the scientific bureaus of these departments, and also three independent establishments of the Government. Through this division a medium is provided for the discussion of matters relating to the general function of research in government and a mechanism is furnished by means of which formal cooperation between governmental agencies and the Council may be effected whenever occasion for doing so arises.

Division of Foreign Relations: The Council also

[1] This is the last of a series of ten articles prepared to describe briefly the nature of the activities upon which the National Research Council has been engaged during the past fourteen years.

maintains a special division to provide for its international relationships. The functions of this division are:

(1) To serve as the agent of the National Research Council in foreign affairs not within the scope of qualified special organizations, and in dealings with the International Research Council which involve the joint interests of two or more international bodies concerned with special branches of science and technology.

(2) To promote cooperation in matters of joint interest among the several American national committees or other representatives of international organizations.

(3) To inquire into the advisability of initiating new international organizations, and to cooperate with the special American groups interested in their formation.

(4) To keep in close touch with the Department of State, and to inform the Department of pending international scientific and technical questions in which the Government may be interested.

(5) To prepare and publish annually a concise summary of American activities in international scientific and technical organizations.

The membership of the Division of Foreign Relations is planned to bring together as many as possible of the organized interests of this country in international scientific affairs. It is composed of representatives of the American sections of the six international unions to which the Council now adheres (representing astronomy, physics, radio-telegraphy, chemistry, geodesy and geophysics, and geography), of representatives of certain governmental agencies having an interest in international scientific affairs and of other American organizations which have a concern in scientific matters abroad. The Foreign Secretary of the National Academy of Sciences is, *ex officio,* the Chairman of the Division of Foreign Relations.

The European contacts of the National Research Council have been mainly with international scientific organizations in the traditional fields of learning. On the Asiatic side the international scientific relations of the Council have centered largely around the problems that are of common interest to the countries bordering upon the Pacific Ocean or lying within the Pacific area. These interests in all fields of science are represented in an organization, the Pacific Science Association, to which scientific bodies in fourteen of the Pacific countries have adhered. The contacts of the National Research Council with this association are in charge of a Committee on Pacific Investigations of the Division of Foreign Relations. Through this committee the Council has participated since 1920 in a series of Pacific Science Congresses, of which the fifth was held in Victoria and Vancouver early in June, 1933. This committee, also, has encouraged the advancement of researches recommended by these congresses as important problems on which cooperation is desirable.

Division of States Relations: The suggestion to include a Division of States Relations in the peace-time organization of the Research Council arose from the relationships of the Council during the war years with state scientific research committees organized in more than twenty of the states as parts of the State Councils of Defense. These state research committees rendered important services during the war period.

The Division of States Relations has been maintained by the Research Council in order to conserve the increased impetus given to state research enterprise during the war and in order to provide a medium for the discussion of conditions attending the work of state scientific agencies. It was felt, however, that any discussion of these conditions should be based upon an understanding of the functions and responsibilities of state government and a knowledge of the governmental organization of the state. This division has therefore given attention to a study of the mechanism of state organization in its relation to the promotion of scientific work. This has been done in two ways: (1) by making studies of the organization and relationships of state scientific agencies, and (2) by providing for occasional discussions in the nature of symposia for the consideration of problems relating to state scientific work.

The division is indebted to a number of collaborators for the preparation of reports on particular topics. One of the first of these reports was an account of the organization and activities of the Committee on Scientific Research of the State Council of Defense of California, which was published as an example of the nature of the service which such a body can render in emergency. The division also issued a report upon the nature and extent of the cooperation existing in scientific work between the Federal Government and non-governmental agencies, chiefly of the state systems, and has sponsored studies of the organization, relationships and work of the state scientific agencies in California, Illinois and other states. A special study was made of the systems of central financial control of research in state governments in several states. Shorter papers have been published upon the value of state scientific work to the commonwealth. Most of these reports and papers were issued as publications of the Research Council. A number of meetings have also been held under the auspices of this division for the discussion of questions raised in these papers and of other conditions affecting the progress of the scientific work of the states.

Division of Educational Relations: The Division of Educational Relations is an outgrowth of relationships

between the National Research Council and a large number of research committees which were organized in American universities during the war. The results of this movement in the universities suggested the possibility of a study of the conditions affecting the research life of American institutions of higher education which, it was thought, might be helpful in bringing about larger development of research facilities in our educational institutions.

With this object in view the division undertook a study of means for the discovery and encouragement of students of superior capacity. In order to learn the experience which faculty members generally have had in meeting this problem the division arranged for representatives of the Council to visit a large number of colleges and universities. Altogether 326 such visits were made at 208 institutions in all parts of the country by eleven representatives of the Council during the seven years in which the division carried on this study.

One of the means considered for the encouragement of superior students was the development of honors courses and of plans for free study in the undergraduate years. The division issued a summary of the several types of honors courses as found in American institutions in 1924, and a year later a revision of this summary showing a considerable extension of honors systems in the liberalizing of the curriculum of that period. The division also considered the grouping of students, when classes are large, into sections on the basis of ability, as a device for benefiting especially the superior individual.

In order to direct the attention of gifted students to the opportunities for a worth-while career in research the division issued a series of over twenty pamphlets describing these opportunities in a number of callings. These papers were distributed without charge to faculty members of colleges and universities for use with their students, more than 128,000 copies having been circulated in this way. A number of other pertinent papers were also distributed, including an "Open Letter to College Seniors," designed to aid advanced students in the rational choice of a career. The division also cooperated with a committee of the American Association of University Professors in a study of means for increasing the intellectual interests of students.

In conjunction with the Divisions of Medical Sciences, and of Anthropology and Psychology of the Council, the Division of Educational Relations sponsored a survey of American schools for the deaf in 1924 and 1925 which became the starting point of a study of the physical causes of deafness, subsequently carried out by the Division of Medical Sciences, and led to the preparation by the Division of Anthropology and Psychology of an extensive program of studies upon psychological problems of deafness, many of which bear upon the special education of the deaf.

This division is therefore continued in the Council in order to provide an opportunity, as occasion may offer, for the study of similar problems of an educational character in which it may serve as a coordinating agency.

OBITUARY

ALBERT MARTIN BLEILE

THE death of Albert Martin Bleile, which occurred on August 16, 1933, brings to a close the career of one of the pioneer physiologists of this country. Dr. Bleile was born at Columbus, Ohio, on June 26, 1856. In 1876 he graduated from Starling Medical College, with the degree of doctor of medicine. He then went abroad and spent three years in study at Vienna, Leipzig and Paris. During this time he was a student of Professor Carl Ludwig. Upon his return to the United States, he began the practise of medicine, and also accepted the post of lecturer of experimental physiology at the Starling Medical College. At this time there was but one laboratory of experimental physiology in the United States, that of the late Professor H. Newell Martin, which had recently been established at the Johns Hopkins University.

Dr. Bleile's real interests did not lie in the practise of medicine; therefore, in 1891, when he was offered the post of professor of physiology at Ohio State University he gladly abandoned his practise and devoted his full time to teaching and research in the field of physiology. He continued in this position until 1931, when he was retired from active work with the title of professor emeritus, which he held at the time of his death.

Dr. Bleile's researches on blood sugar and the inversion of cane sugar by gastric juice were of fundamental importance and laid the foundation for modern investigation. He also published important work on the cause of death by electric shock, the composition of urine in epilepsy, the effect of section of the vagus nerve on the heart and on the detection and recognition of bloods.

During the latter part of his life he published nothing. This in a large part was due to his feeling that much of the flood of scientific literature was superficial and unimportant, and therefore, his failure to publish was at least in part a protest against such superficial work. However, he was always engaged in some type of experimental work, and was always ready and willing to give advice to his younger colleagues in

matters pertaining to their own research. Many of his students considered him cold and forbidding, but those who knew him best know that at heart he was a kindly old gentleman, always willing to be helpful to a student who was sincere and conscientious.

His death leaves a vacancy in the field of physiology which can not be filled. There are now left in the United States only two men who studied in Ludwig's laboratory, Professor Warren P. Lombard, of the University of Michigan, and Dr. Henry Sewell, of Denver, Colorado.

F. A. H.

WILLEM STORM VAN LEEUWEN

ON July the thirtieth there died in the prime of life one of the leading pharmacologists of Europe. Willem Storm van Leeuwen was born in Kampen, Holland, on December 7, 1882. The son of an army officer, he obtained his early education in the military academy of Breda. He was graduated as a cavalry officer and sent on service to the East Indies in 1905. There he contracted malaria, and he was forced to return to Holland in 1907, when he began his medical studies in Utrecht, receiving his degree in 1912.

His interests lay in research and he became an assistant to the famous pharmacologist, Rudolf Magnus, with whom he continued until the world war. During the war, Storm van Leeuwen substituted for Magnus at the University of Utrecht, delivering lectures and carrying on research until 1920, when he was made professor of pharmacology and director of the Therapeutic Institute in Leiden, where he was active until his death.

In 1919, prior to his appointment as professor in Leiden, Storm van Leeuwen made a visit to the United States, where he met many scientists and visited numerous laboratories. His impressions of America were described in a book which won for him many friends, on the one hand, and a number of enemies, on the other, because he never minced words, told the truth and denounced sham.

The earlier researches of Storm van Leeuwen dealt with anesthesia and narcosis. Another important earlier contribution was a study on the relation between the concentration and biological effect of drugs and poisons. This research led him into the fascinating field of synergism and antagonism of drug mixtures, in which he was a pioneer worker. In addition to miscellaneous researches on digitalis, belladona, ergot, vitamins, etc., Professor Storm van Leeuwen devoted much of his time during the last decade to the study of asthma, hay fever and various forms of allergy. Here some of his most valuable contributions to medicine were made. He was one of the earliest investigators to emphasize the importance of air conditioning; that is, of freeing the air of all allergic particles in connection with the treatment of patients suffering from such diseases. Being interested not only in theoretic pharmacology but also in its practical applications to therapeutics, Storm van Leeuwen combined his laboratory researches with clinical tests which he carried on in a private clinic of his own and also in the municipal hospital at Leiden. His studies on bronchial asthma and other allergic diesases led him into the domain of climatology and meteorology, so that in the last few years of his life he spent considerable time at Innsbruck, observing the effects of atmospheric electricity, ionized gases and various meteorological factors on physiological and pharmacological phenomena.

Professor Storm van Leeuwen's publications number more than 150, and fully half of them deal with various phases of anaphylaxis, allergy and allied conditions. Next in importance are his papers on synergism and antagonism of drugs. Other publications deal with the absorption of poisons, the influence of colloids on the action of drugs, the relation of avitaminosis to pharmacological action, the pharmacology of sulfur, salicylates, hypnotics, anesthetics, tuberculin and other drugs. He was also the author of several larger handbooks. The most important of these are his "General Pharmacology," written in Dutch, and his treatise on "Allergic Diseases," published in Dutch, German and English.

Professor Storm van Leeuwen was one of those pharmacologists who believed in combining laboratory experiment with carefully controlled clinical investigation; in other words, he made the practical application of pharmacology to therapeutics. Not only was Storm van Leeuwen an excellent lecturer and teacher, but he also possessed the rare ability of popularizing important scientific findings for the benefit of the intelligent laity.

Perhaps his most outstanding personal traits were his scientific sincerity, his devotion to and his admiration of scientific investigators, irrespective of social or political status, race or creed, and his hatred of hypocrisy and adulation in academic circles. He was no false hero worshipper nor devotee of what E. T. Dingwall, psychologist, has recently termed "the new witchcraft, under the spell of which the scientific manner of thinking is forgotten and the student accepts conclusions because they are advocated by some person of prominence." It was probably for this reason that he disliked the modern Nazi "kultur," but was a lifelong friend of such German scholars as the late Maximilian Harden, Rudolf Magnus, and others.

The death of Storm van Leeuwen is a heavy loss not only to his family and friends but also to all those seriously engaged in the pursuit of scientific truth in general and of pharmacology in particular.

DAVID I. MACHT

SCIENTIFIC EVENTS

THE BRITISH POST-GRADUATE HOSPITAL AND MEDICAL SCHOOL

THE corner-stone of the new building of the British Post-Graduate Hospital and Medical School at Hammersmith was laid recently by Mr. Neville Chamberlain.

According to the London *Times*, a representative committee, under the chairmanship of Mr. Neville Chamberlain, was appointed as long ago as July, 1925, to draw up a practical scheme of post-graduate medical education centered in London, and their report was issued on April 9, 1930. They recommended the establishment of a joint institution by means of the conversion of the existing Hammersmith Hospital, at which the four hundred beds required at the outset of the scheme were already available. The committee stated that it was of urgent importance that the serious defect that there was no hospital and medical school in London exclusively devoted to providing post-graduate medical education should be remedied by the establishment of a British post-graduate hospital and medical school. They considered that such an institution should include from the outset a hospital with not less than four hundred beds, a medical school on the scale appropriate to a hospital of this size, residential accommodation for the post-graduate students of the hospital and medical school, and provision for expansion.

When the scheme began to assume definite shape it was proposed that approximately £500,000 should be spent on it, about half to be provided by the London County Council and the other half by the government. Since then, however, it has been modified from time to time, and during the economic crisis of a year or two ago it was shelved for the time being.

The scheme now to be carried out is estimated to cost about £200,000, of which the London County Council will be responsible for half and the government half. The commitments in respect of the scheme up to the present amount to £103,595, which will be borne by the government and the County Council in the proportions of £50,195 and £53,400, respectively.

ANNUAL MEETING OF THE METALLURGICAL ADVISORY BOARD

AT the invitation of the Carnegie Institute of Technology, metallurgists from all parts of the country will gather at Pittsburgh on October 20 for the seventh annual open meeting of the Metallurgical Advisory Board. Reports of research activities at the institute will be made by investigators and will be discussed by experts from the industry, thus furnishing a valuable interchange of opinion between the theoretical and practical side of steel making.

At the opening session to be held in the Carnegie Union, Jerome Strauss, chief research engineer of the Vanadium Corporation, will preside. Dr. F. N. Speller, chairman of the advisory board, will make the address of welcome.

The opening report will be made by Dr. Robert F. Mehl, director of the metals research laboratory at Carnegie. During the first year of its reorganization the laboratory has undertaken a number of new lines of research. The studies of iron-manganese and iron-manganese-carbon alloys has been continued throughout the year and will be reported. The constitution of the ternary iron-manganese-carbon alloys with 2.5 and 4.5 per cent. manganese has been finished; the electrical conductivity and thermal magnetic properties of binary magnetic alloys have been investigated, and the constitution of high manganese binary iron-manganese alloys has been studied. The studies nearly complete the proposed program on these alloys. In addition to these research subjects, the laboratory has inaugurated two new general programs, on precipitation from solid solutions and on internal strains in metals.

New work will be reported by Dr. Francis M. Walters, Jr., on the study of the formation of ferrite from austenite in low carbon steels in which a new dilatometer, which bids fair to be of considerable use in metallurgical investigations, will be described.

The studies on internal strain, to be reported by Dr. C. S. Barrett, have to do principally with x-ray determinations of internal strains in worked and heated metals and alloys. A new x-ray method will be reported which offers an opportunity to determine stress distribution in the surface of stressed materials. The complete research program on this subject will be presented and discussed at the meeting.

At the afternoon session Mr. L. F. Reinartz, representing the open hearth committee of the American Institute of Mining and Metallurgical Engineers, will preside. Dr. V. N. Krivobok, head of the graduate metallurgical work at Carnegie, will report on his recent studies of corrosion-resisting and heat-resisting alloys.

The work of the research staff of the Metallurgical Advisory Board for the year has consisted chiefly in open hearth studies designed to enable the operator to control the finishing stages of liquid steel manufacture to a much finer degree than has been heretofore possible. To date, methods have been worked out in detail for high carbon steels, and studies have been started on low carbon steels for deep drawn products.

As a corollary to this work the problems of variation in response to heat treatment and age hardening are being studied with particular respect to the effect

of the oxygen content of liquid steel. In this connection non-aging steels have been produced which have superior properties to the ordinary structural steels with regard to the ductility of the steel and its ability to withstand high temperature heat treatment without detriment to its physical properties. This work will be described by Dr. Charles H. Herty, Jr., director of cooperative research, and his assistants.

Following the presentation of papers members of the board will hold the annual business meeting. In the evening an informal dinner will be held at the Hotel Schenley with Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, presiding. The speaker for this meeting will be announced later.

These annual meetings of the board have grown in importance each year, and at the last meeting, despite business conditions and the slackening of industrial research, more than four hundred persons attended.

THE CENTENNIAL OF THE BASIC LAWS OF FARADAY

SEPTEMBER 12 marked the hundredth anniversary of Michael Faraday's discovery of the two basic laws of electrochemistry: Faraday observed that the amount of metal or gas produced at the cathode during electrolysis was directly proportional to the amount of current passing through the cell. The internationally accepted value of the ampere is based on this cell. Faraday furthermore found that upon connecting several cells in series, these cells containing different metal solutions, the amount of metal deposited upon the first cathode was equivalent to that of the second cathode, and this in turn equivalent to that of the third cathode and so on. Or, in other words, the same quantity of electricity sets free the same number of equivalents of substances at the electrodes.

The Electrochemical Society celebrated this centennial on the evening of September 8, the day that had been set aside by the Century of Progress Exposition at Chicago as "Faraday Day." Members and guests gathered in the large auditorium of the Illinois Host Building. Among those present was Mrs. Walter S. Faraday, of Chicago, widow of a grandnephew of Michael Faraday; Professor Robert S. Hutton, Goldsmiths' professor of metallurgy, University of Cambridge, England, and a charter member of the society, gave the principal address. Dr. Hutton reviewed the remarkable career of Faraday, illustrating his address with a series of reproductions of the pages of Faraday's note-book and diary.

Dr. George W. Vinal, of the Bureau of Standards, displayed a number of different types of coulometers which were exact replicas of those used and designed by Faraday. Dr. Vinal also demonstrated the laws of Faraday, using solutions of copper and of silver.

At this meeting the Edward Goodrich Acheson Medal and $1,000 prize were bestowed upon Dr. Colin G. Fink.

RECENT DEATHS

GEORGE HENRY PERKINS, vice-president emeritus of the University of Vermont and dean emeritus of its department of the arts and sciences, died suddenly on September 12. He would have been eighty-nine years old on September 25. When he gave up teaching this summer he had been a member of the faculty for sixty-four years. Dr. Perkins had been state geologist since 1898 and was Howard professor of natural history from 1869 to 1931.

DR. JOHN C. SHEDD, professor of physics in Occidental College from 1916 to 1930, and professor emeritus for the last three years, died on May 20, at the age of sixty-four years.

DR. CHARLES LEWIS BEACH, president emeritus of Connecticut State College, formerly professor of dairy husbandry at the University of Vermont, died at Storrs on September 15, at the age of sixty-seven years. He had been ill for some years and resigned the presidency in 1928.

DR. RAMSAY WRIGHT, who retired in 1912 as professor of biology at the University of Toronto, died on September 6, in Worcestershire, England, at the age of eighty-one years.

DR. WALTER GROSS, professor of pathology and pathological anatomy in the medical faculty at Münster, committed suicide on September 15.

SCIENTIFIC NOTES AND NEWS

DR. FRANK BLAIR HANSON, professor of zoology at Washington University, St. Louis, has been appointed assistant director of the Natural Science Division of the Rockefeller Foundation. Dr. Hanson returned from Paris a year ago after a two-years leave of absence, during which time he was fellowship administrator in Europe of the Rockefeller Foundation.

PROFESSOR HEZZLETON E. SIMMONS, head of the department of chemistry and a specialist in rubber technology at the University of Akron, has been ap-

pointed president to succeed Dr. George F. Zook, who recently became United States Commissioner of Education.

DR. JULIUS STIEGLITZ, professor of chemistry and chairman of the department of chemistry at the University of Chicago, became professor emeritus on July 1. Dr. Stieglitz continues as professor on a special appointment.

DR. E. O. ULRICH, who retired last year as geologist of the U. S. Geological Survey, and Dr. R. Ruedemann, New York State paleontologist, have been elected corresponding members of the Society of Natural History, Frankfurt.

AWARDS of merit for 1933 have been made by the American Congress of Physical Therapy for meritorious work with radium to Dr. Claudius Regaud, associate director at the Curie Institute, Paris; for merit in physical medicine to Dr. Walter J. Turrell, of the University of Oxford; for merit in developing electro-surgery to Dr. Harvey Cushing, of Yale University; for pioneer literary work in physical medicine to Dr. Gustavus M. Blech, of Chicago, and for merit in radiology to Dr. Gustav Bucky, of New York.

DR. ARTHUR ROCHFORD MCCOMAS, past president of the Missouri State Medical Association, was given a testimonial dinner during the recent seventy-sixth annual meeting of the association in Kansas City. Dr. McComas has served as chairman of the council of the association continuously since 1916, except for the year of his presidency in 1922.

THE issue of the *New English Journal of Medicine* for July 13 was in honor of Dr. Robert B. Osgood, who retired in 1931 from the chair of orthopedic surgery at the Harvard Medical School. It contains a foreword by the late Sir Robert Jones.

DR. LLOYD L. DINES, formerly professor of mathematics and junior dean of the college of arts and sciences at the University of Saskatchewan, has been appointed head of the department of mathematics at the Carnegie Institute of Technology.

DR. DONALD K. TRESSLER, chief chemist for the Birdseye Laboratories of Gloucester, Massachusetts, has been appointed chief of research in chemistry and head of the division of chemistry of the New York Agricultural Experiment Station at Geneva. At that station Dr. D. C. Carpenter, of the division of chemistry, has been transferred to the dairy division, where he will engage in special dairy chemistry research.

DR. RAYMOND T. BIRGE, chairman of the department of physics at the University of California, announces that the following research associates of the department will be in residence at Berkeley during the academic year 1933–34: National Research Council fellows—Dr. Robley D. Evans, working with Professor L. B. Loeb, Dr. Wendell H. Furry, working with Professor J. R. Oppenheimer, Dr. F. N. D. Kurie and Dr. Edwin M. McMillan, working with Professor E. O. Lawrence; Professor Rafael Grinfeld, Rockefeller Foundation fellow from La Plata University, working with Professors Birge and F. A. Jenkins (until December, 1933); Dr. R. L. Thornton, Moyse scholar from McGill University, working with Professor Lawrence. In the radiation laboratory of the department, Dr. Malcolm C. Henderson, Dr. John J. Livingood and Dr. M. S. Livingston are continuing as research associates with Professor Lawrence. Other research associates are Dr. John F. Carlson and Dr. Melba N. Phillips, working with Professor Oppenheimer, Dr. Afton Y. Eliason, working with Professor H. E. White, and Dr. Frederick W. Sanders, working with Professor Loeb. Mr. Telesio Lucci continues as research assistant in the radiation laboratory. Among the graduate students are Mr. B. B. Kinsey, Commonwealth fellow from Cambridge University, and Mr. Milton G. White, Charles A. Coffin Foundation fellow.

THE appointment at the University of Cambridge of the following university lecturers for three years from October 1 is announced: A. E. Goodman, Gonville and Caius College, Aramaic; H. L. H. H. Green, Sidney Sussex College, anatomy; R. Williamson, Clare College, pathology; L. R. Shore, St. John's College, and F. Goldby, Gonville and Caius College, have been appointed university demonstrators in the department of anatomy for three years from October 1.

ACCORDING to the *Journal* of the American Medical Association, Professor Dr. Ernst Rüdin, who is associated with the German Research Institute for Psychiatry at Munich, has been appointed a representative of the federal ministry of the interior in the German Society for Racial Hygiene. He has assumed direction of the society and has moved its headquarters from Berlin to Munich. The previous chairman was Professor Eugen Fischer, director of the Kaiser Wilhelm Institute for Research in Heredity and the newly elected rector of the University of Berlin. Through the recent death of James Loeb, of the United States, this institution received a bequest of $1,000,000, as a culmination of many previous gifts during the lifetime of its benefactor.

DR. A. E. KENNELLY, professor emeritus of electrical engineering at Harvard University and the

Massachusetts Institute of Technology, sailed for Europe on September 1.

E. L. KIRKPATRICK, of the Wisconsin College of Agriculture, has been relieved of his duties for one semester to permit him to assist in the federal program, where he will serve as rural relief analyst and adviser to the various groups engaged in that work.

DR. ALBERT C. SMITH, associate curator of the New York Botanical Garden, sailed on September 9 from San Francisco on his way to the Fiji Islands, where he will spend a year gathering plants, traveling on a fellowship from the Bishop Museum in Honolulu in cooperation with Yale University. He will stop for two weeks in Hawaii. At the end of his year's leave of absence he will return to the garden to work on the identification of his specimens.

DR. STILLMAN WRIGHT, formerly limnologist of the U. S. Bureau of Fisheries, one of several skilled investigators lost from the service because of the needs of economy, has sailed from New York for Rio de Janeiro to join the Brazilian Government in a study of fish farming possibilities in the numerous artificial lakes and reservoirs in northeastern Brazil.

DR. GEORGE GAYLORD SIMPSON, associate curator of vertebrate paleontology at the American Museum of Natural History, and Coleman S. Williams, his assistant, left for Buenos Ayres on September 9. On this excursion, the expedition, which is financed by H. S. Scarritt, of New York, will seek relics of extinct South American mammals.

BARNUM BROWN, of the American Museum of Natural History, is continuing exploration in Montana and Wyoming of the Lower Cretaceous beds of those states, especially on the Crow Indian Reservation in Montana. *Natural History* reports that this is the third season devoted to this field. In 1931 and 1932 twelve dinosaur skeletons were excavated and two large Sauropod skeletons were discovered, partly explored and re-covered, near Graybull, Wyoming, in the Bighorn Basin. These two skeletons are covered by ten feet of sandstone, which Mr. Brown plans to remove over an area of 65 x 45 feet, but the skeletons will not be removed this year.

DR. REUBEN L. KAHN, director of laboratories of the University Hospital and assistant professor of bacteriology, University of Michigan, is sailing for Rome, at the invitation of the Volta Foundation of the Royal Academy of Italy. The foundation has arranged immunological meetings to take place in Rome from September 25 to October 1. Dr. Kahn will present two papers. One is entitled, "The New Serology of Syphilis"; the other, "Tissue Reactions in Immunity."

THE Italian section of the Permanent International Commission on Labor Medicine and the Italian Society of Industrial Medicine will sponsor a celebration of the third centennial anniversary of the birth of Bernardino Ramazzini on October 4, at the University of Milan. Representatives of most of the countries of Europe will attend and will discuss the influence of Ramazzini on industrial medicine in the various states. The following day a special meeting devoted to discussion of ancylostomiasis will be held at the clinic, with the foreign physicians as participants. In addition to the Milan celebration, the universities of Modena, Padova and Parma, with which Ramazzini was associated at various times, will hold ceremonies in his honor, on October 6.

Industrial and Engineering Chemistry reports that the international technical committee of the third Congress of Technicians and Chemists in Agricultural Industries recently met in Paris to organize another of these congresses, to be held in Paris from March 28 to April 5, 1934. The congress was undertaken by the French Association of Chemists of Agricultural Industries under the patronage of the French Ministry of Agriculture and the above dates have been tentatively set.

STEVENS INSTITUTE OF TECHNOLOGY is planning for the first week in December of the current year a celebration at Hoboken, New Jersey, of the fiftieth anniversary of the graduation from the institute of Frederick Winslow Taylor. The celebration is planned to occur during the annual meetings of the American Society of Mechanical Engineers and the Taylor Society. The cooperation also of various other bodies having primary interest in modern management is assured. These bodies and the various engineering colleges are being invited to send delegates, and greetings are being solicited from men in other countries whose names have been associated either with Taylor's philosophy specifically or with modern management generally. As tentatively contemplated at the present time, the celebration will include an afternoon and evening with the possibility that some features may occupy the morning hours. Arrangements are being made for something impressive and historically significant in the way of a demonstration of metal-cutting. The Stevens Institute students are working on two dramatic sketches illustrative of incidents in Taylor's career as a student and at Bethlehem. There will be an interesting exhibit of Tayloriana supported by many contributions from Mrs. Taylor and from men associated with Taylor's activities over the period from 1883 until his death. At a reception during the afternoon, it is expected that members of Mr. Taylor's family and many of his associates will be

present. There will be an informal dinner in Hoboken and in the evening a commemorative meeting with an address by some person of national reputation.

THE *Journal* of the American Medical Association writes: "The council of the Royal College of Surgeons is advertising all over the English-speaking world the vacancy caused by the resignation of Sir Arthur Keith as conservator of the museum and director of research. Advertisements have been sent not only to the English medical journals and the *Times* but to the Australian, New Zealand and Canadian medical journals and to the *Journal* of the American Medical Association. The duties include charge of the museum in all departments, the laboratory at Lincoln's Inn Fields and the Buckston Brown research farm. The conservator has to report to the Museum Committee on all objects offered either as donations or for purchase or in exchange to complete the catalogue of the collection and to continue and correct it from time to time. He has to register particulars of every specimen acquired by the college and to classify and arrange all additions to the collection. His whole time is to be at the disposal of the college and he is required to deliver lectures illustrated by the contents of the museum. The salary offered is $5,500 per annum with an honorarium for lectures, which amounts to about $500. Grants are also made to defray expenses in journeys abroad to inspect other collections. All applications must be received by October 7."

A NEW section has been established in the Agricultural Adjustment Administration to handle codes and problems in connection with the capture, processing and distribution of fish and fish products. R. H. Fiedler, chief of the Division of Fishery Industries of the Bureau of Fisheries, has been detailed as chief of the new section. Lawrence T. Hopkinson, of the United States Tariff Commission, and Robert S. Hollingshead, of the Foodstuffs Division of the Bureau of Foreign and Domestic Commerce, both of whom are experienced in matters concerned with the fisheries and fishery industries, also have been detailed to the section. The fisheries section will have jurisdiction over codes affecting the fishery industries, with the exception of matters pertaining to hours of labor and rates of pay, which come under the National Recovery Administration.

SERIOUS curtailment of the work of the Bureau of Public Administration at the University of California during the ensuing year, which was threatened by the drastic cut in state support, has been made unnecessary by the receipt of a gift of $20,000 from the Rockefeller Foundation of New York, according to an announcement made by President Robert Gordon Sproul following the September meeting of the regents.

STANLEY F. MORSE, consulting agricultural engineer, has formulated and is directing the ten-year agricultural development program of Sumter County, South Carolina. The objects of this program are (a) to reduce the costs of producing farm products, (b) to raise standardized products of marketable quality, (c) to market these products through the Farmers' Exchange that has been organized. To secure basic facts on which to build this program the South Carolina Experiment Station, under the direction of Professor H. W. Barre, has made an agricultural economic survey of Sumter County, the results of which are embodied in Bulletin 288. To provide additional data a new soil survey of this county is also being made. The successful carrying out of this program is being based largely on the cooperative efforts of the farmers themselves who are working on the principle that "the best help is self-help." Mr. Morse was formerly professor of agriculture and director of agricultural extension of the University of Arizona, and his experience as an agricultural consultant has included thirteen foreign countries.

ACCORDING to a correspondent of the London *Times*, the Adelaide University and Museum scientific expedition, which has spent some time in the interior of Australia studying the social organization, customs, language and physical characteristics of the aboriginals, has returned to Adelaide. It has brought back a collection of plaster casts of faces and busts and specimens of native handiwork, as well as cinema and sound records. The chief protector of aborigines, Mr. McLean, and Dr. Cecil Hackett, of the University of Adelaide, were out of touch with civilization for ten weeks, and the other eight members of the expedition camped in the Musgrave Ranges, 300 miles north of Oodnadatta. Mr. McLean, who is specially reporting to the government, said that the aborigines were in good condition and he had not heard any evidence of their ill-treatment by whites. Those not in contact with whites had retained their primitive vigor and independence, and were reproducing themselves at the normal rate.

THE Department of the Interior, through the Bureau of Reclamation, announces that the area around the 115-mile lake which will be formed when the great Boulder Dam is completed will be set aside as a public reservation and recreation park. Camping, fishing and boating parties will use the free sites around the shores. The Federal Government is planning a network of new roads, through the bureau of public roads. These roads will top the transcontinental lines, connect Boulder Canyon region with Zion Park and Grand Canyon routes. Overland traffic of the

Santa Fé trail will go across the top of the dam, which will serve as a bridge across the Colorado. At Black Canyon, the dam will form a wall of smooth cement, 700 feet in height.

THE final report on the production of electricity in the United States in 1932, released by the Department of the Interior through the Geological Survey, shows that a total of 83,153,000,000 kilowatt-hours was produced for public use in 1932. Of this total 41 per cent. was produced by the use of water power and 59 per cent. by the use of fuels. The proportion of the total output produced by the use of water power was more in 1932 than ever before. The total output in 1932 was 9.4 per cent. less than in 1931, which in turn was 4.4 per cent. less than in 1930, and the output in 1930 was 1.5 per cent. less than in 1929, the year of maximum output. The output by the use of water power in 1932 was 11.4 per cent. greater than in 1931, and the output by the use of fuels was about 20 per cent. less than in 1931. The total output in 1932 was about 14.5 per cent. less than in 1929; the demand for electricity has therefore held up well in comparison with other industries during the three years of the depression. The increase in efficiency in the use of coal, oil and gas in the generation of electricity, which has been accomplished consistently each year since 1919, was continued during 1932. The average amount of coal and coal equivalent of oil and gas consumed in generating 1 kilowatt-hour of electricity at public-utility plants was 1.51 pounds. In 1919 the consumption of coal per kilowatt-hour was 3.2 pounds. The steady continuation of this increase in efficiency, especially during these three years of unfavorable load conditions, speaks well for the operators of public-utility power plants.

DISCUSSION

HAILSTONE DAMAGE TO BIRDS

ON Thursday night, April 20, 1933, Baton Rouge, Louisiana, and vicinity was visited by a local thunder storm accompanied by considerable hail. Most of the hail fell between 8:30 and 9 o'clock in the evening. The hailstones varied in size a great deal, the maximum size reported being as large as "hens' eggs," according to the newspapers.

The center of the storm apparently passed through the city of Baton Rouge, coming from the west and traveling slightly northeast from here. Hail was reported about twenty-five miles west of Baton Rouge and about twenty miles east. The width of the hail-storm apparently was not over twenty miles across.

Many thousands of dollars worth of damage was done in the city of Baton Rouge, with relatively little damage at distances north and south six to eight miles away.

One of the interesting results of this storm was the enormous destruction of bird life. On the morning following the storm, many dead birds were found on the campus of the Louisiana State University and reports from the immediate vicinity out from Baton Rouge showed even a heavier mortality. Immediately north of Baton Rouge in the suburb Istrouma in an open area, approximately five acres in size, one man collected 26 bob-whites which had been killed by the storm. These were spotted by pointer dogs, so it is likely that this represents the major portion of the birds killed in this area.

Meadow larks, sparrows, mocking-birds, Virginia cardinals and other birds were found by students on the campus and could be seen killed along the highways leading to the city. The number of birds actually killed on the highways would probably average one bird to each half mile, but a highway represents a very narrow strip of territory and one not containing many birds. It does, however, give a little idea of the mortality which must have taken place in the surrounding neighborhood. From this it can be seen that the total destruction of the birds over the entire area visited by hail must have been enormous.

An interesting item in this connection is also the fact that apparently a large flock of scarlet tanagers must have been passing through this vicinity on the night of this storm. Aside from the bob-whites which were spotted by dogs, there were more scarlet tanagers reported as having been killed than any other one species of bird. The total number of tanagers reported to the zoology department, excluding all possibilities of duplication, was twenty-seven. This number merely represents the number of males killed and seen. The female with her dull color is not identified by the laymen. It was only the scarlet-colored males that were noticeable. It is probably safe to say that an equal number of females in the same area were killed. Three of these scarlet tanagers were captured alive with merely a broken wing. One of them was kept alive in the department for nearly two weeks. One of the other two is still living at the present writing.

This mortality represents simply the birds killed within territory frequented by persons and does not include a large amount of wooded, swampy or other territory not frequented by people. It is probable that of scarlet tanagers alone, including the entire

area covered by the storm, several thousand birds must have been killed or injured.

A few birds were apparently injured through the nervous system, as several of these birds were brought into the laboratory alive and with no visible anatomical injury, but yet were absolutely unable to fly or run. While some of these birds, notably a Virginia cardinal, seemed to recover to the extent of eating normally, they apparently never regained their power of flight, although kept for some little time.

An interesting note in respect to the scarlet tanagers is the fact that the captive birds seemed to adjust themselves to their environment within a cage very readily and quite completely, behaving like cage-raised birds almost from the start of their captivity.

WM. H. GATES

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ON THE STRUCTURE OF THE ANTHOCEROS PLASTID IN REFLECTED LIGHT

IN a number of recent papers the writer[1] has spoken of the living plastid as being composed of a more or less visually homogeneous chlorophyll impregnated cytoplasm in which there appeared one or more starch-containing cavities. In addition it seemed possible from Zirkle's[2] account of plastid structure that a system of canals might be present. No attempt has been made to understand the submicroscopic structure of the plastid cytoplasm or the chlorophyll-cytoplasm relationship.

The fixed plastid may appear as a honeycomb structure[3] or it may be transversed by definite and regular plates.[1] More usually it appears as a homogeneous cytoplasm in which starch grains and pyrenoids are embedded.[4]

Due to the appearance of the living plastid and to the more common appearance of the fixed plastid it was concluded that the platework structure was an artifact in the sense that fixation brought into prominence a structure not visible in the living cell. Since, however, in many cases of apparently good fixation this platework is an extremely regular structure it was concluded that it must represent surfaces of physiological activity.

Through the kindness of the Leitz Company I have recently been enabled to study the appearance of the anthoceros plastid with the reflected light of the ultropak. My study has of necessity been rather superficial but it nevertheless has yielded certain results which because of their bearing on the nature of plastid structure seem worthy of publication. It has further clearly demonstrated the need of examining material by reflected as well as transmitted light before attempting to definitely decide upon the structure of living bodies. It is hoped that laboratories equipped with the ultropak may in the near future undertake studies upon living material.

Two rather different but interlocking appearances of the same anthoceros plastid may be obtained with the ultropak depending to a certain extent upon the shadows cast by the metal disks interposed between the light source and the objective. The plastid may appear as an aggregate of green vesicles. If one adds to the preparation an alcoholic solution of iodine the vesicular appearance disappears. The plastid now seems to be a homogeneous mass of differentiated cytoplasm in which blue staining starch grains may be observed. Apparently each one of the vesicles of the living plastid is a starch grain surrounded by its own mass of starch-elaborating, chlorophyll-impregnated cytoplasm.

With other shadows cast by rotating the metal disk the spaces separating the vesicles become the more prominent structure in the plastid. We now have what appears to be homogeneous green mass, in which one clearly distinguishes narrow canals or plates of some darker green substance marking out regular patterns in the lighter green ground cytoplasm. The picture thus obtained coincides well with the fixed and osmicated haematoxylin stained platework.

In the center of many plastids the region of pyrenoids is clearly visible. In some this region is quite filled with something, in others it appears quite empty, while still other plastids show regions of bright spots not at all understood.

Not considering the pyrenoid region, it appears that the starch-containing region of the anthoceros plastid is composed of starch grains surrounded by their own individual mass of chlorophyll impregnated cytoplasm. These individual vesicles are separated from each other by a space of cytoplasm apparently differentiated from that surrounding the starch grain. We may define the anthoceros plastid as a localized region of chlorophyll impregnated cytoplasm, in which small vesicles of starch-elaborating cytoplasm are separated from each other by regions of yet differently formed cytoplasm.

Just what influence this concept of the plastid will have upon the writer's ideas of the similarity between the plastid and the golgi zone is as yet too early to say. Some recent personal communications with Dr. Severinghaus may, however, be of interest. It seems that from the work of Bowen, Nassonov and Severinghaus the animal secretion may arise in little vesicles of cytoplasm so differentiated from the remainder of the cell that it reduces the osmium tetroxide. If this

[1] T. E. Weier, *Biol. Bull.*, 62: 126–139; *Am. Jour. Bot.*, 19: 659–672, 1932.

[2] C. Zirkle, *Am. Jour. Bot.*, 13: 301–341, 1926.

[3] B. M. Davis, *Bot. Gaz.*, 28: 29–109, 1899.

[4] McAllister, *Am. Jour. Bot.*, 14: 246–257, 1927; R. A. Harper, personal communication.

be true the correspondence of plastid and golgi region would be even closer than at present supposed.

T. ELLIOT WEIER

FLUSHING, N. Y.

ON THE GENERA CTENOGOBIUS AND RHINOGOBIUS GILL, TUKUGOBIUS HERRE, AND DROMBUS JORDAN AND SEALE

ON my trip to the Philippines in 1931 I obtained 997 species of fishes, a wonderful testimonial to the richness of aquatic life in the waters of that favored group of islands. In studying such a large number of species it was necessary to reexamine closely numerous genera; this was especially true in studying the 88 species of gobioid fishes secured.

In 1858 Gill imperfectly defined the genus *Ctenogobius* from a Trinidad species and there has never been a satisfactory limitation of the genus since. The latest characterization by Koumans in 1932 is the best yet written, but is too inclusive and overlooks important characters.

In 1859 Gill described *Rhinogobius similis* from Japan, but he never published a description of the genus. Ever since authors have confused *Ctenogobius* and *Rhinogobius*, although an examination of the type species will show good generic differences.

In 1927 I described *Tukugobius* from the Philippines, largely on the character of the ventrals.

Recently I have examined a large series of *Rhinogobius similis* Gill, from Japan, and the related species from Japan and Formosa, and have compared them with the three species of *Tukugobius* described by me from Luzon. They are all very closely related and are all evidently true *Rhinogobius*. In all of them the ventrals are very short, forming a nearly circular powerful adhesive disk, with a characteristic thick bilobed or deeply crenate frenum. They are very much like the ventrals of the genus *Sicyopterus* and closely related genera of the *Sicydiini*, except that they are free and not adherent to the belly, as in *Sicyopterus*.

Tukugobius Herre is therefore an exact synonym of *Rhinogobius* Gill.

Ctenogobius Gill has the ventrals of the ordinary goby type, and we may refer to it most of the species given by authors under *Rhinogobius*, which have a truncate or emarginate tongue and naked opercles and cheeks.

In 1905 Jordan and Seale created the genus *Drombus* to receive a new Philippine goby, but their generic distinction was not well drawn. It is, however, a valid genus, distinguished chiefly by having 6 to 9 rows of teeth in each jaw, and having the nape scaled to the eyes.

Rhinogobius, *Ctenogobius* and *Acentrogobius* have been used as dumping grounds and more or less interchangeably for divers sorts of gobies. By limiting the name *Rhinogobius* to those gobies agreeing with *Rhinogobius similis* in the peculiar formation of their ventrals we can eliminate at least a part of the confusion. If gobies were two feet long, Dr. Jordan once said, they would be well known. As it is, few people are willing to scrutinize them closely enough to work out their real similarities and differences.

ALBERT W. C. T. HERRE

STANFORD UNIVERSITY

BIOLOGY AND THE PRINCIPLE OF REPRODUCIBILITY

IF a discipline is a science, *i.e.*, if the phenomena which it considers may be treated logically by the scientific method of experimentation, prediction and confirmation by further experiment, these phenomena must be reproducible. That is, if two undisturbed systems of the type being considered are at any time identical, they must remain identical through all time, or until one of them is disturbed. Furthermore, there must be a correlation between systems displaced with respect to each other in time. If system A at time t_1 is identical with system B at time t_2, then system A at a later time $(t_1 + T)$ must be identical with system B at time $(t_2 + T)$.

The phenomena of the inorganic world are reproducible in this sense, although the results of simultaneous identical experiments on identical systems are not necessarily identical. The famous indetermination principle of Heisenberg states that, if a great number of identical systems be divided into two groups, then the results of simultaneous measurement of a certain quantity on each member of a group will be distributed about a mean value: this mean and the distribution will be identical for the two groups. It states further certain relations between the widths of the distributions arising from the measurement of certain pairs of quantities. The actual uncertainty in the result of a single observation is appreciable only for systems of molecular dimensions, and in macroscopic systems the reproducibility is of the rigid type known as causality. It is well to remember, however, that an uncertainty of this type is only a necessary, and not a sufficient, condition for inferring supernatural intervention.

It is obviously of prime importance to know whether biological phenomena are reproducible. The answer of the uncompromising vitalist is "No!", the uncompromising mechanist answers "Yes: Causally so." Adherence to the extreme vitalistic view-point makes the scientific study of biology logically impossible, since the course of an event observed in the past

can give us no hint of the probable course of a similar event in the future. Experimentally, also, this position is untenable, since a number of the fundamental biological processes (photosynthesis in wheat and other plants, the phototropisms of certain plants and animals, etc.) have been shown to be accurately reproducible, and a number of other fundamental processes (photosynthesis of sugars, the photodecomposition of CO_2 by chlorophyll[1]) have been isolated and repeated in inorganic systems of known reproducibility. On the other hand, it appears definitely impossible to interpret biological phenomena in terms of the now known processes in inorganic systems, and the question must be regarded as unsettled. It may be, as von Uexküll has maintained, that the production of identical biological systems is fundamentally impossible. Certainly it is impossible to the experimental technique of the present day: synthetic men with interchangeable parts are still a dramatist's dream.

Many vitalists cite the apparently purposive actions of organisms in support of their contentions. This is logically justifiable only if it can be shown that identical organisms under identical conditions exhibit diverse purposes which are not even statistically reproducible. If the reactions, though purposive, are reproducible, they are not fundamentally different from the reproducible reactions of inorganic systems, and we may suspect hitherto unrecognized natural laws, of universal application, but illustrated only by the exceedingly complex systems which constitute organisms (precisely as the laws of electrostatics are illustrated only by electrified bodies). The view-point which considers biological processes to be reproducible, and controlled by natural laws of universal validity but limited illustration, is often called "vitalism," but the name "organicism" has been proposed to distinguish it from that vitalism which sees supernatural intervention in every action of a living thing.

It is interesting to note that Professor Niels Bohr, in his latest study of the foundations of the quantum mechanics, has proposed the introduction of teleological elements into the structure of the inorganic sciences.

EUGENE W. PIKE
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PRINCETON, N. J.

[1] According to a private communication from Dr. K. Meyer, of the University of Zurich.

"A RARE PUBLICATION"

UNDER this title Mr. Wm. J. Fox[1] has given some notes on the "Transactions of the Natural History Society of Queensland, Vol. 1, 1892–94."

Such notices as this usually invite the making of a search and often result in the valuable disclosure of copies in unexpected places. Attention is therefore called here to the fact that the journal is to be found in several libraries in Australia.

In a late catalogue by E. R. Pitt[2] copies are listed for the following:

The Commonwealth Parliament, Canberra.
Australian Museum, Sydney.
Linnaean Society of New South Wales, Sydney.
Mitchell Library, Sydney.
Royal Society of New South Wales, Sydney.
Royal Society of Queensland, Brisbane.
Public Library, Adelaide.
Royal Society of Tasmania, Hobart.
Field Naturalists' Club, Melbourne.
National Museum, Melbourne.
Royal Society of Victoria, Melbourne.
Public Library, Perth.

Evidently only one volume of *Transactions* was issued.

VERONICA J. SEXTON
LIBRARY, CALIFORNIA ACADEMY OF SCIENCES

[1] SCIENCE, n. s., 77: 1997, pp. 351–352, April 7, 1933.
[2] "Catalogue of the Scientific and Technical Periodicals in the Libraries of Australia," edited by E. R. Pitt, Melbourne, 1930, p. 707.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

MANIPULATION OF THE RESEARCH MICROSCOPE

WHEN examining a smear preparation on a slide with the highest powers of the microscope (especially oil immersion) one makes a rather systematic exploration by starting at the top (or bottom) of the slide and working across in definite bands or areas.

In going from one band to another, the following procedure is usually taken: The operator selects a distinguishing or characteristic bit of material on the limit of one band and, using this object as a guide by continually keeping his eyes fixed upon it, turns the one knurled knob of the mechanical stage until another area of sufficient width (next band) comes into view. When he believes he has about the right width which his lenses will enable him to study at one time, he then uses the other knob of the mechanical stage to move said band left to right (or the reverse) for the exploration. This operation must be repeated until the entire slide is, of course, completely studied.

Such a procedure of slide examination after many hours becomes extremely tedious and rather subjec-

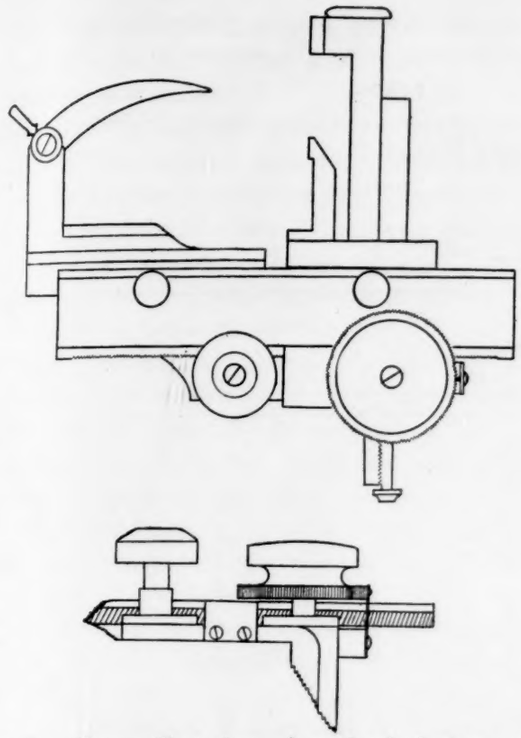

FIG. 1. *Above*—Top view of mechanical stage, showing "clicking" device. *Below*—Side view of part of mechanical stage, showing "clicking" device.

tive, especially when the material is a more or less uniform smear preparation of blood cells, bacteria, protozoa, etc., or of any objects of very small size. Some investigators use the vernier on the mechanical stage for slide exploration but this is an inconvenient and painstaking task and in a great many cases can not be used to advantage. The vernier is usually used by investigators in recording valuable data found on the slides.

This is essentially a "clicking" device placed slightly above and built into the mechanical stage. It is controlled by the knurled knob of the stage which moves the slide up and down. The device consists mainly of a finely made notched wheel with a metal tongue that fits snugly into the notches. The notched wheel is so calibrated that by using a 10x ocular and a 1.8 mm objective, one slight turn of the knob results in a definite click which indicates that one band has come into view. The operator then turns the other knob of the mechanical stage to move the slide left to right, as the case may be, to complete studying the one band. This, of course, is repeated until the entire slide is thus systematically studied.

Such a device should be a great aid to the investigator who must use the research microscope constantly. It enables him to examine a slide, scientifically and accurately, without any subjective approximations of his own. It also saves a considerable amount of time in slide study. An important item in its favor is that the strain on the operator's eyes is lessened. In fact, it can even afford him a second's relaxation after studying each band until the next click is heard. The device should prove to be invaluable in studying smear preparations of blood, blood diseases, bacteria, protozoa, etc., where the smear is more or less uniform and calls for very close and accurate exploration of the slide.

The writer uses the device in conjunction with a 10x ocular and 1.8 mm oil immersion objective for studying protozoa.

This device on the mechanical stage can be secured from the Spencer Lens Company, Buffalo, New York. They are also able to install the "clicking" device on their ordinary mechanical stage.

RALPH WICHTERMAN

TEMPLE UNIVERSITY

MICRO MOUNTS FOR REVERSE VIEWS

IN a recent number of SCIENCE,[1] Professor Jacot mentions the use of a special objective for the examination of the reverse side of micro mounts, especially for Acarina. It may interest him and others having the same problem to state that the use of Cellophane for mounts as described in SCIENCE last June[2] can be used with balsam or other media, although my description in SCIENCE referred especially to dry mounts.

I have balsam mounts of Acarina, thrips and Mallophaga, now six months old, with every appearance of indefinite preservation and with all the convenience of glass slides along with the advantage of high power microscopic use from either side, very compact storage and safety from breakage.

HERBERT OSBORN

OHIO STATE UNIVERSITY
COLUMBUS, OHIO

THE letter of Dr. Arthur Paul Jacot in No. 2015 of SCIENCE relative to the examination of the reverse side of micro mounts prompts me to describe a somewhat unconventional technique I have used for a similar purpose.

A strip of tin, aluminum or bakelite of micro slide size (one by three inches) and of thickness suitable to the material to be mounted and the mounting medium (usually .3 to .8 millimeter) has a one-half-inch hole pierced in its center; a No. 2 cover glass three quarters of an inch square is then cemented in the center of one side, forming a cell. A strip of ordinary writing-paper one inch wide is then wrapped three times around each end and cemented down, the combined thickness equaling or slightly exceeding that of the cover glass.

The specimen to be examined is now mounted as usual and covered with a second cover glass similar

[1] SCIENCE, 78: 2015, 128, August 11, 1933.
[2] SCIENCE, 77: 2007, 587, June 16, 1933.

to the first. Finally, a strip of kraft paper the size of the slide and with a one-half-inch hole in the center is cemented to each side of the slide.

Specimens prepared in this way have been found to be quite durable and to resist handling very well; and, of course, they may be used either side up without interfering with the correction of the ordinary objective or condenser.

WALTER J. SPIRO

WHITE PLAINS, N. Y.

SPECIAL ARTICLES

THE EFFECTS OF ALTERNATING CURRENTS UPON CUTANEOUS SENSORY THRESHOLDS

I BEG to express appreciation of Dr. Peterson's interesting historical communication on local electric anesthesia.[1] The note by Dr. Inman and myself[2] dealt with the application of a certain phenomenon to the anatomical procedure of outlining cutaneous nerve areas, rather than with the phenomenon itself; Dr. Peterson's note directs attention to the latter, and seems to render desirable the following discussion, which, however, is merely preliminary to more ample publication.

Seeking to improve Hughson's method of outlining cutaneous nerve areas by using the small alternator referred to in our note, Dr. Inman and I found that at certain levels of current strength the cutaneous area supplied by the nerve under the influence of the current was sufficiently insensitive to light touch to be outlined with reasonable accuracy and consistency, which was not true of painful and thermal sensations; although we recognized some effect upon the other thresholds, especially that of pain, only in the case of touch was it striking. My assistants and I have lately directed our efforts toward establishing quantitatively the occurrence or non-occurrence of the differential masking which Dr. Inman and I believed that we detected, utilizing the larger generator mentioned in our note, and elaborating accurate methods of gauging cutaneous sensory thresholds; a preliminary report has appeared.[3]

Fig. 1 exemplifies the results obtained in a number of experiments upon several subjects; some of its points may seem obscure, pending a detailed account of technique and discussion of results. It does show, however, a clearly differential susceptibility to elevation by the current on the part of the thresholds of the different sensations. In our experiments with the superficial branch of the radial nerve, the threshold for pressure[4] was most susceptible to elevation by such means, next that for touch; pain was affected much less than these, but usually quite significantly; whilst the elevation of the thresholds for heat and cold was very slight, inconsistent and probably insignificant.

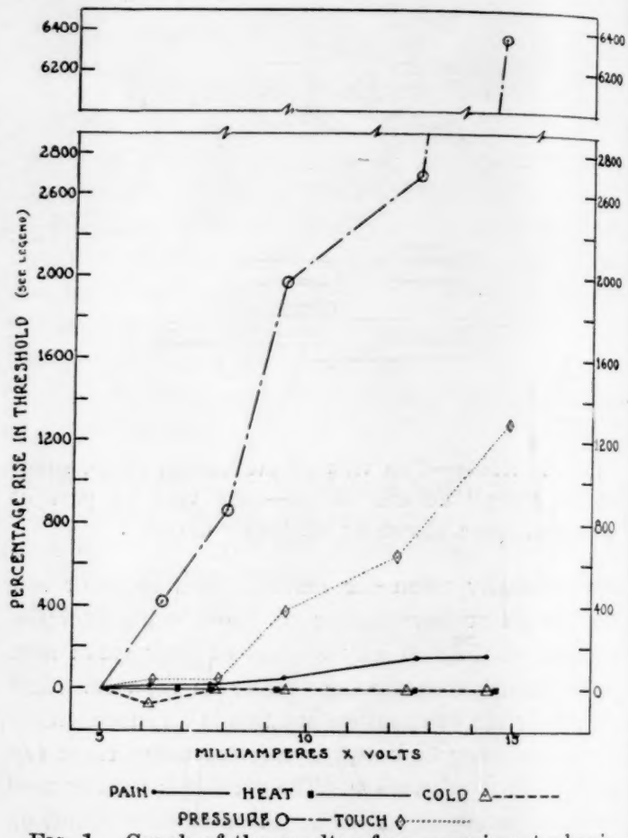

FIG. 1. Graph of the results of an experiment wherein the superficial branch of the left radial nerve was subjected (through the skin) to the influence of an alternating current of 400 cycles per second, and of strength increasing as indicated along the abscissa. The thresholds of the sensations were measured at different spots in the area supplied by the nerve, each sensation being tested at the same spot throughout the experiment. Before each experimental observation, the normal threshold for that sensation was measured. The ordinate records the rise in threshold above the immediately preceding normal reading, expressed as a percentage of the average of the normals throughout the experiment.

Since the appearance of our note, Dr. Arthur S. Gilson, Jr., of the Department of Physiology, Washington University, St. Louis, has informed us (*in litteris*) that, using the current from a Thyratron oscillator, he and Dr. H. B. Peugnet have obtained

[1] F. Peterson, SCIENCE, 77: 326, 1933.

[2] I. M. Thompson and V. T. Inman, *ibid.*, 77: 216, 1933.

[3] I. M. Thompson and A. Barron, *Anat. Rec.*, 48: 35 (Suppl.), 1931.

[4] Probably the sense of pressure is neither simple nor cutaneous. The outstanding sensitiveness to this current of the threshold for pressure was revealed by our method of stimulating (as we think) the sensation of pressure apart from that of touch.

qualitative results like those indicated by Dr. Inman and myself; I am grateful for permission to include this statement herein.

Comparison of the differential susceptibility of thresholds to this current with the results of other types of interference with nerves (*e.g.*, pressure, local anesthetics, section and recovery) suggests itself, as do explanations in terms of the work of Ranson, Erlanger, Adrian and others; to these matters we shall presently address ourselves.

The local "benumbing" effects of various electric currents have been known for a very long time, electric local anesthesia figuring prominently in the medical literature of 1858, and appearing sporadically since then. In spite of occasional reports of success, it has not proved consistently satisfactory for clinical purposes, which does not surprise us, in view of our experience as exemplified in Fig. 1.

Robert[5] used the phrase "anesthésie de diversion," expressing the idea that there is no reduction of physiological sensibility (as in true anesthesia), but diversion or occupation of attention, with diminished perception. We think that it is confusing to call this anesthesia, and prefer Robert's other term "masking." At present our interest is centered upon the strikingly differential quality of this phenomenon, to which, so far as we know, we first drew attention.[3]

I. MACLAREN THOMPSON
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FUNCTION OF THE ROUND WINDOW[1]

SOME time ago, Hughson and Crowe, of Baltimore, reported[2] that when the membrane, which closes the round window of the cochlea, is "made rigid by pressing on it with a plug of moist cotton, the perception of spoken words and practically all tones is increased at least 50 per cent." Later it was suggested that if a fascial graft were implanted in contact with the round-window membrane, thus reducing its normal mobility, the impaired hearing of those who are partially deaf could be distinctly ameliorated. These statements, by virtue of their scientific and clinical implications, have aroused the keen interest of all who are concerned with problems of hearing.

The first question seems to be: Will an animal, whose round-window membrane is thus blocked with a plug, actually *hear better* (respond to fainter sounds) than normally?

The subject (dog) is placed in a stock with right fore-paw resting on a metal grid (which can be charged with electricity). A stimulus-tone (1,000 cycles) is sounded for two seconds, directly followed with a charge just strong enough to effect hasty withdrawal of the foot. The animal soon learns to withdraw his paw as soon as tone begins, thereby avoiding the imminent shock. When the tone is made fainter and fainter, he continues to react as long as he hears it; when it becomes inaudible, he no longer responds. Auditory acuity in a dog may thus be measured with great precision and consistency. The normal limen having been established, each bulla is exposed on its ventral aspect through which a circular hole is reamed; the round-window recess appears directly opposite. A plug is gently pressed into the fossula and brought into snug contact with the round-window membrane. (Plug consists of moderately soft gum enveloped in gauze, the whole forming an elongated saccule of mesh filled with gum). The bulla-opening is closed with a rubber stopper to protect middle ear from extraneous fluids. Within five hours animal's hearing is tested; the plug is then immediately withdrawn by an attached thread and hearing again tested. The change in performance from plug *in* to plug *out* is regularly (ten animals) positive: hearing is impaired whenever plug is in contact with the membrane and again improves when plug is withdrawn. In the first five cases, while our technique was still developing, the gain = 8.0 decibels, standard deviation = 4.11; in the second five, after procedure was perfected, the gain comes out far more sharply and consistently (10.0 db, s.d. = .84). The operation itself (merely entering the bulla) was found, by test, to have no appreciable effect upon the limen.

The second question is: How do these plugs affect electrical pick-up from the auditory nerve? Animal is prepared by entering one bulla, as before, and also exposing the homolateral nerve. A whistle of 1,000 cycles, operated by an interrupted air-stream, provides an ideal stimulus-sound. The electric pulses thus evoked in the nerve are led off by an electrode into ear-phones, where they can be reduced by means of an attenuator until they become just inaudible to the observer. The pick-up with plug *in* and plug *out* can thus be readily measured and compared. The same effect appears with every animal tested (thirteen in number): plug in, sound is reduced; plug out, sound is increased. (First half of cases, mean gain = 4.4 decibels, s.d. = 1.46; second half, mean gain = 9.9 decibels, s.d. = 2.52.) The following relation is thereby established: plugging the round-window fossule reduces both the animal's ability to hear and also the electrical pulses over the auditory nerve. Despite wide-spread discussion of the "Wever-Bray effect," little or no evidence has hitherto been submitted to show whether the effect does, or does not, correlate with actual hearing.

[5] Robert, *L'Union Médicale*, 12: 487, 1858.

[1] Communication No. 1 from the Alpha Research Laboratory. A generous grant in aid of this work by the Trustees of the Research Fund, American Otological Society, is gratefully acknowledged.

[2] *Jour. Am. Med. Assn.*, 96: 2027, 1931.

Our findings clearly support the "classical" theory of hearing in relation to the round-window's function. There being certain differences between the Hopkins procedure and our own, however, no factual contradiction need be inferred.

Our working conclusions are: (1) that our gum-plugs, which meet the round window in direct apposition but with no pressure, impede its normal oscillation and thereby impair acuity of hearing, as the accepted theory of cochlear function would lead one to expect; (2) that actual hearing is affected in the same sense by our procedure as are the electric pulses which can be picked up from cochlea and auditory nerve.

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FREQUENCY-DISTRIBUTION OF VOLUME OF ISLANDS OF LANGERHANS IN THE PANCREAS OF MAN, MONKEY AND DOG

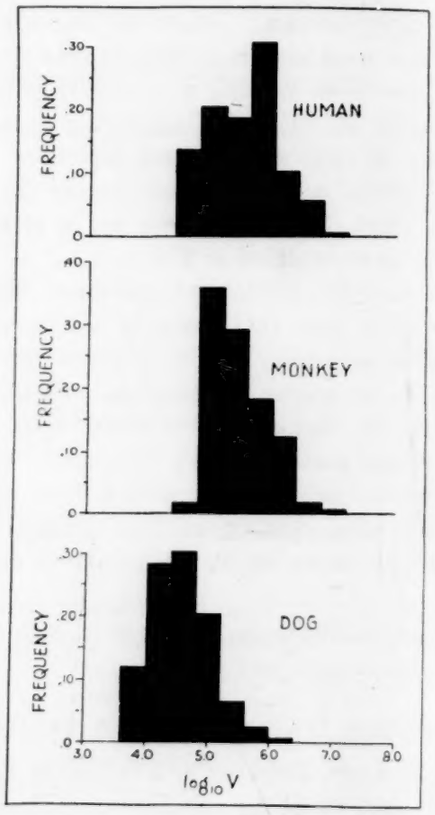
A METHOD of estimation of the volume (V) of Islands of Langerhans has been described elsewhere[1,2] and measurements of 100 islets from a monkey's pancreas presented. The construction of class-frequency diagrams, however, is not as simple as usual, because the selection of samples was necessarily not random; but methods of dealing with such samples with equal effectiveness have been given.[1,2] Relation (3) of the first paper may be used for the calculation of any of the moments, and in particular for the estimation of the frequency of occurrence of a volume within a given interval.

Islets were chosen for measurement by selecting from a cross-section one of the total number, Z, of islet particles. If α be the number of these belonging to the same islet and η be the number of serial sections containing some part of the islet, then the system of weights adopted is given by the respective values of $\frac{Z}{\alpha \cdot \eta}$, the justification for which has been discussed in the second paper.[2] Thus the estimated frequency (F) of occurrence of volumes within a given interval (I) is given by

$$F = \frac{\sum_{I} \frac{Z}{\alpha \cdot \eta}}{\sum \frac{Z}{\alpha \cdot \eta}} \qquad (1)$$

where the summation in the numerator is over values obtained when V is in I and that in the denominator is over the whole sample.

Frequency-distribution diagrams have been obtained in this manner from the data mentioned above as well as from similar data from the pancreas of a man and that of a dog. As these were all strikingly skewed we have presented instead the corresponding diagrams for the logarithm of volume in the text figure, where the unit of volume is the cubic micron (μ^3).



The lack of a prolonged tail to the left in each of the diagrams is worthy of note. According to the hypothesis that no islets are formed after a certain stage in life (possibly prenatally) we might expect to obtain diagrams of this sort, whereas just the opposite would be the case were islets formed throughout life. Furthermore, if the so-called geometric (or logarithmic) character of cell proliferation be maintained or at least that at all times for any two islets of the same pancreas the ratio of their rates of proliferation be equal to the ratio of their volumes, then we should find the same form of distribution of the logarithms of their volumes (as given in the diagrams) at all times with merely a possible shift in position of the whole along the axis of abscissae. It is interesting to note the equality of range in the figures given.

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[1] W. R. Thompson, *Biometrika*, 24: pp. 21–26, 1932.
[2] W. R. Thompson, R. Hussey, *et al.*, *Biometrika*, 24: pp. 27–38, 1932.